SPURS Overview

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WHOI

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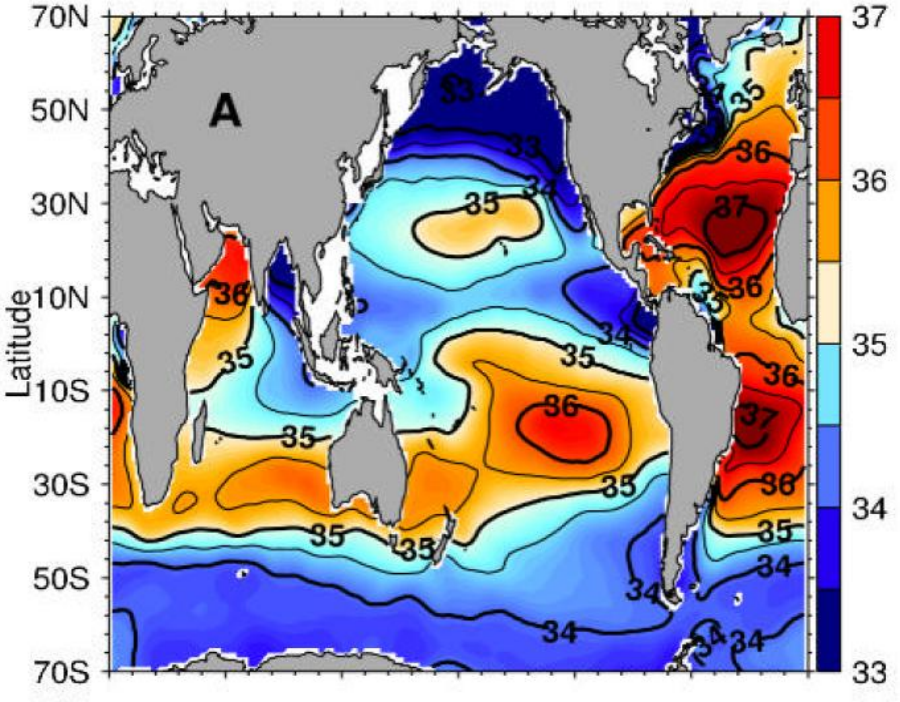
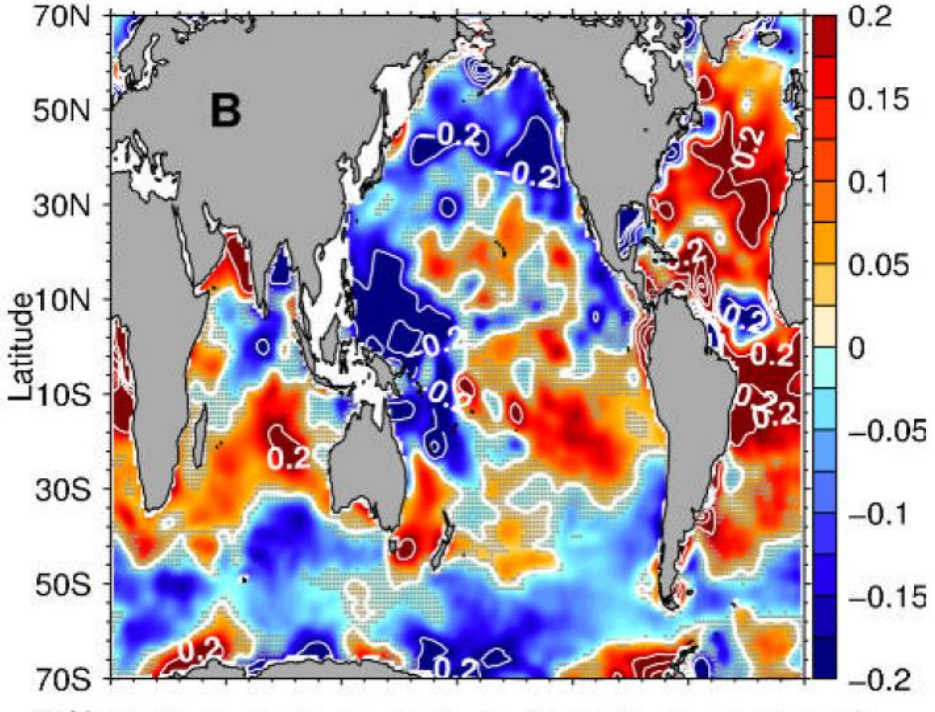
Durack and Wijffels, 2010 *J. Climate*

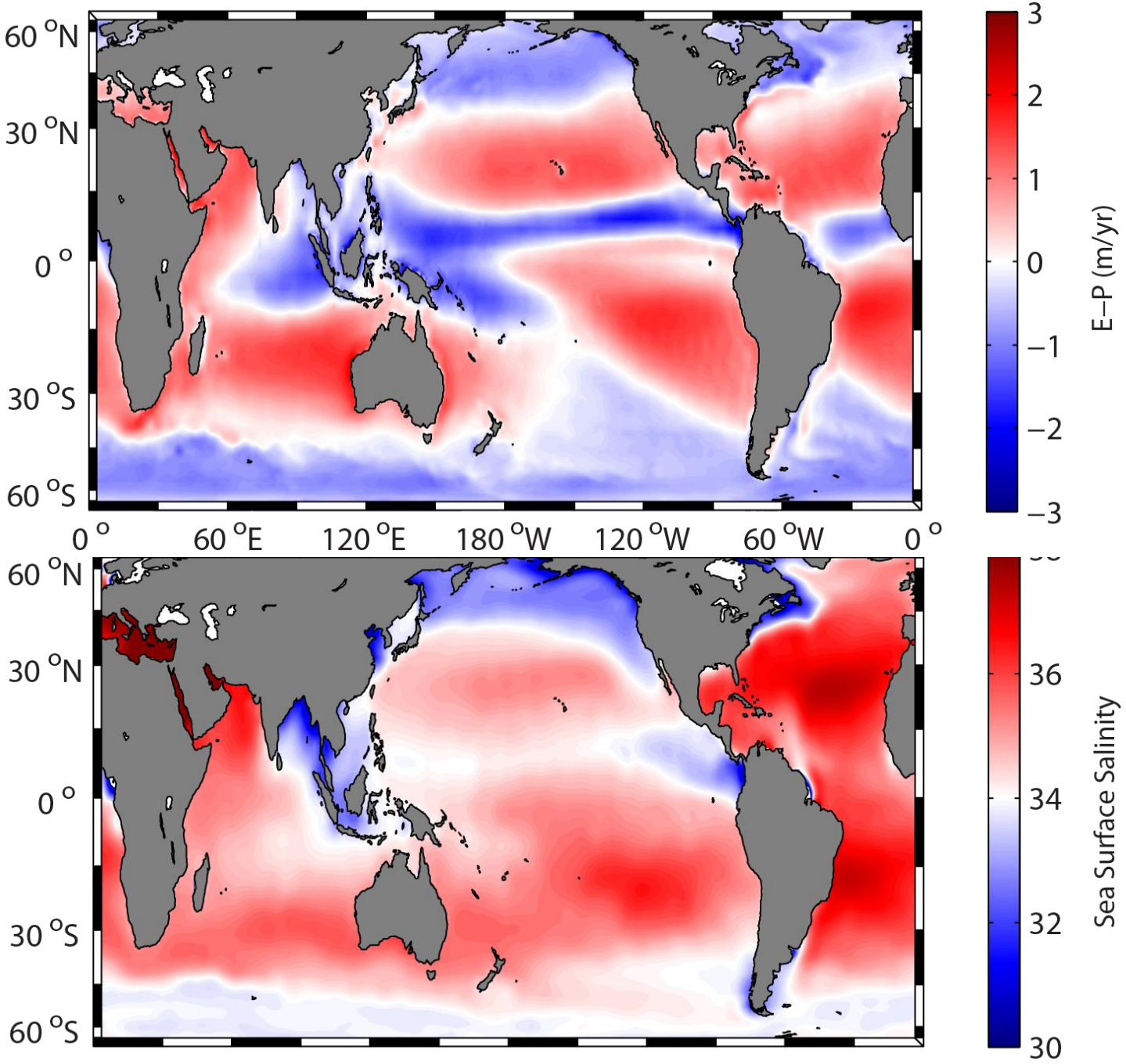
Salinity trends suggest that the water cycle is intensifying rapidly, and we need to understand how the ocean is responding and possibly contributing to the trends. Thus, we designed two experiments the "Salinity Processes Upper-ocean Regional Studies": SPURS-1 and SPURS-2

Mean SSS



50 yr trend in SSS




60 °N
30 °N
0 °
30 °S
60 °S
0 °
60 °E
120 °E
180 °W
120 °W
60 °W
0 °
3
2
1
0
−1
−2
−3
E−P (m/yr)
36
34
32
30
Sea Surface Salinity

Salty versus Fresh

SPURS-1	SPURS-2
Convergent Ocean (Subducting) Divergent Atmosphere	Divergent Ocean (Obducting) Convergent Atmosphere
Salinity Maximum	Salinity Minimum
Evaporation dominated → Buoyancy loss	Precipitation Dominated → Buoyancy gain
Deep mixed layer and thermocline	Shallow mixed layer and thermocline
Weak Mean Advection	Strong Mean Advection
Small Annual Cycle	Large Annual Cycle
Poleward limit of tropical-subtropical cell	Equatorward limit of tropical-subtropical cell
In the saltiest ocean basin, N. Atlantic	In the freshest ocean basin, N Pacific
Positive Long-Term Salinity Trend	Negative Long-Term Salinity Trend

SPURS-1

- Salinity Maximum in the North Atlantic
- 5 Cruises, 3 US, 1 French, 1 Spanish
- Moorings, floats, gliders and drifters were deployed from August 2012-October 2013 and Sea-Soar, CTDs, microstructure profilers gliders and TSGs, and surface sampling “snakes” were used from the ships.
- Results presented this afternoon.

SPURS-2

- Site is to be eastern Tropical North Pacific
- Fresh because of ITCZ and water vapor transport from the Atlantic across Central America (“Downwind” of SPURS-1).
- Focus more directly on near-surface processes (shallow thermocline and barrier layers)

Lukas and Lindstrom, 1991

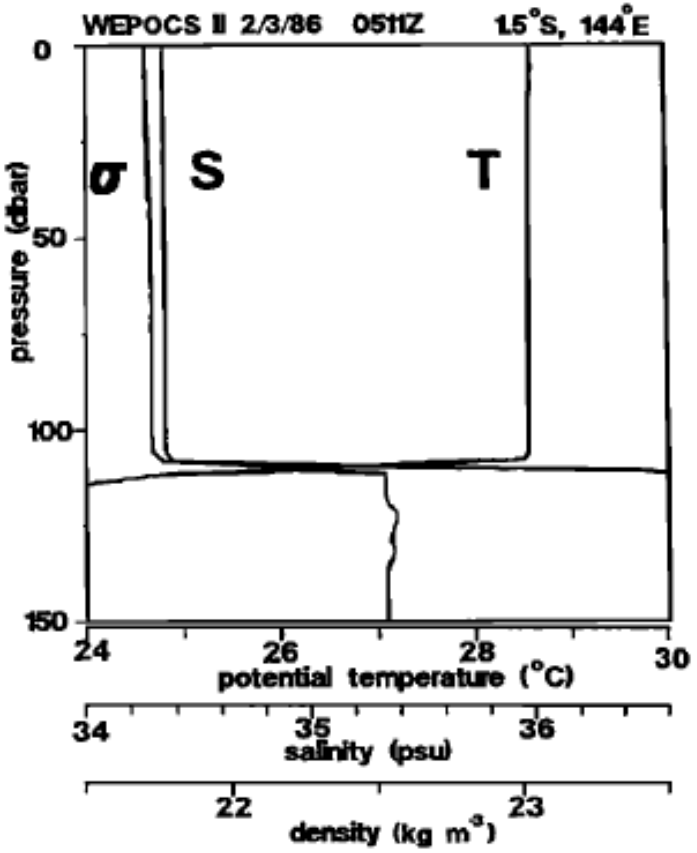


Fig. 2. Potential temperature, salinity, and potential density from a CTD profile at 1.5°S, 144°E in February 1986.

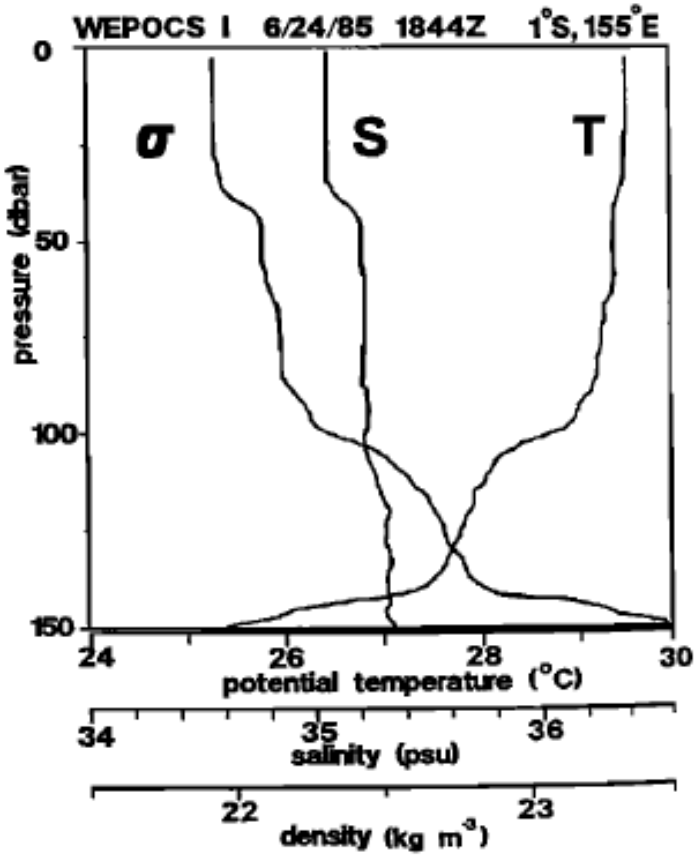
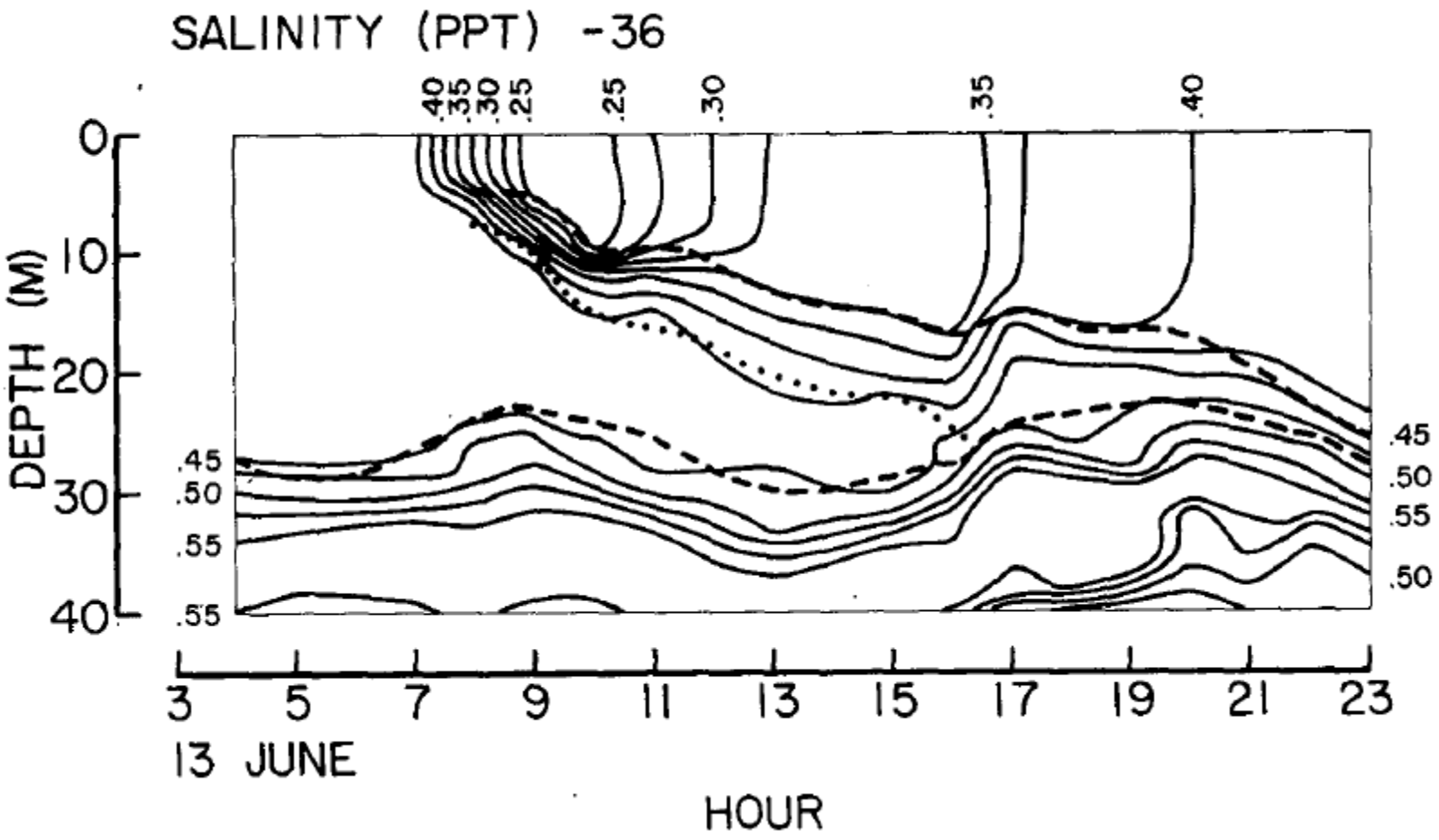


Fig. 3. Potential temperature, salinity, and potential density from a CTD profile at 1°S, 155°E in June 1985.

Price, 1979. Observations of a rain-formed mixed layer



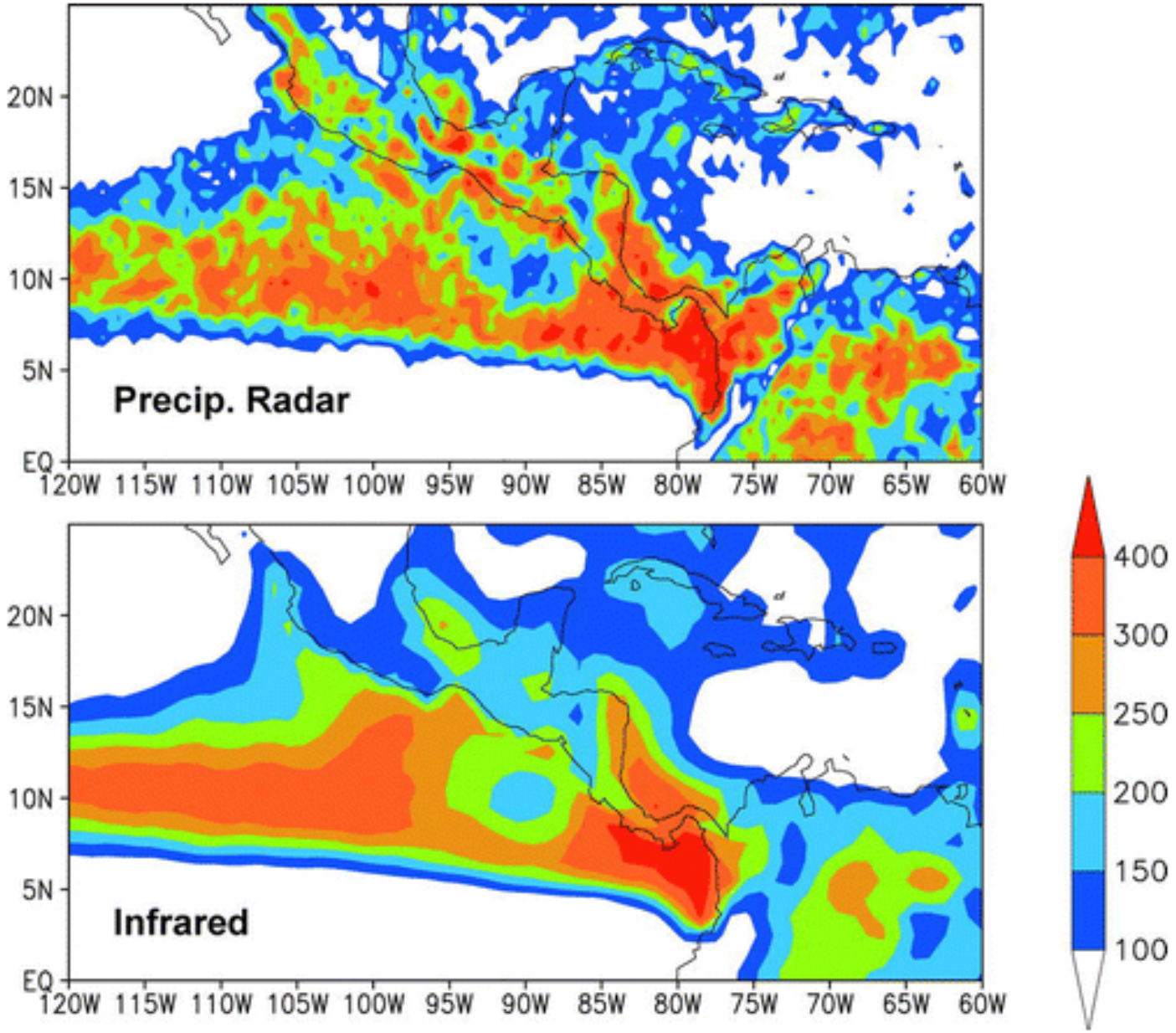


FIG. 10. Jul–Oct precipitation (mm month^{-1}) based on the (top) TRMM PR (3A25G2) and (bottom) infrared (3B43) measurements

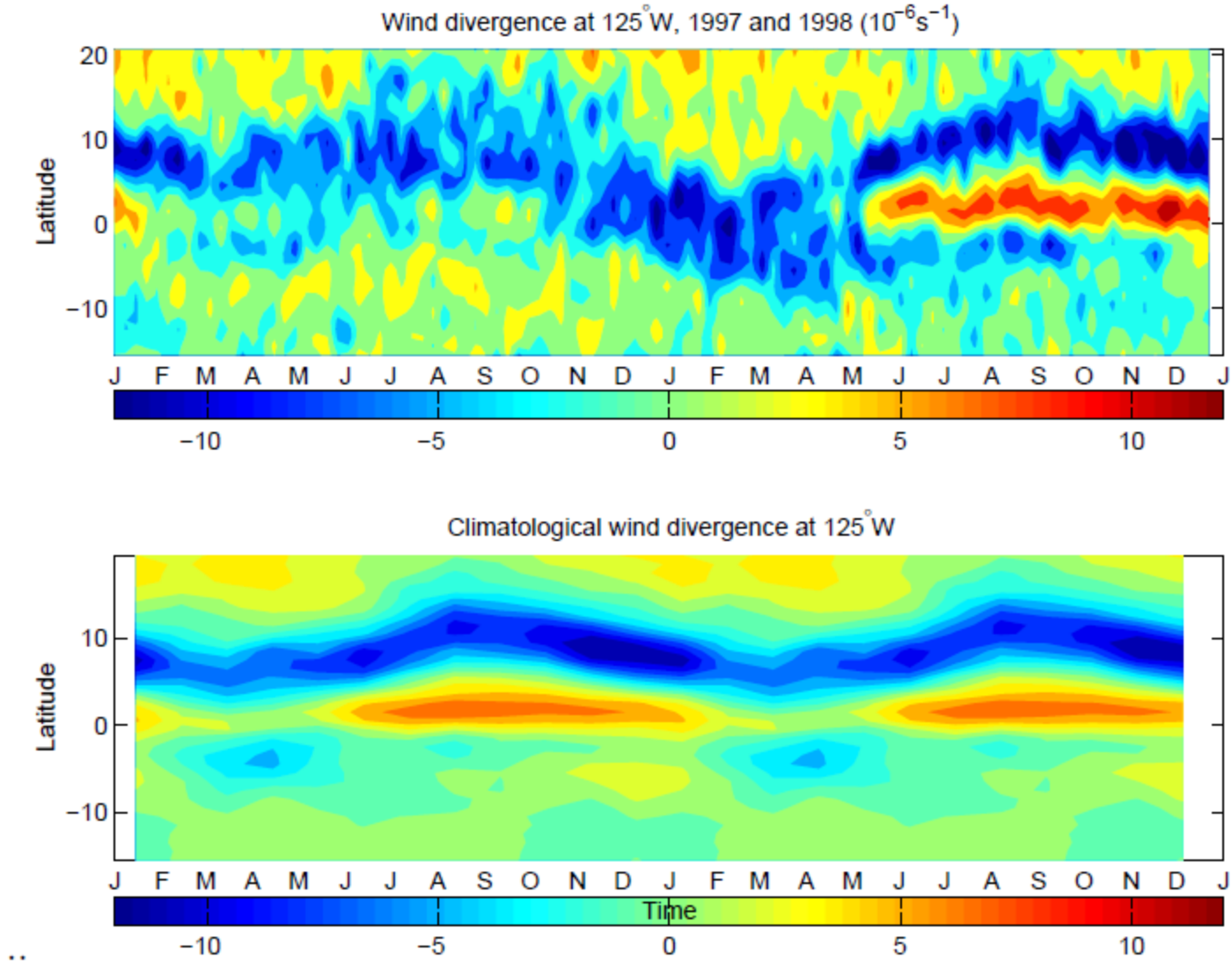


Figure 3-6: Latitude-time plot of wind divergence at 125°W estimated from the IFREMER ERS scatterometer wind product. Upper panel: 1997 and 1998. Lower panel: climatology. The band of wind convergence (i.e. negative divergence) is a rough measure of the location of the ITCZ.

SPURS-2 Scientific Questions

The workshop held in Pasadena April 16-18, 2014 identified several key scientific questions for the SPURS-2 field program:

- What governs the structure and variability of upper ocean salinity near the ITCZ?
- What local and non-local effect does this freshwater flux have on the ocean and what are the feedbacks on the atmosphere?
- Where does the fresh water go, with input from the scales of raindrops to meso-scale fresh patches to the east Pacific fresh pool?
- How does the ocean integrate the fresh water forcing and destroy the salinity variance created at the surface?

SPURS-2

- Site = 10^{o} N, 125^{o} W (away from coastal influences, more general for ITCZ across the Pacific)

- Schedule: start late 2015 or early 2016

- All contributions welcome (SSS drifters, VOS, gliders…)